

BIOLOGY OF *EUXESTA QUATERNARIA* LOEW (DIPTERA: OTITIDAE)^{1,2}

Jong S. Yoon, M.T. Mathew, R.E. Holman³

ABSTRACT: The picture-winged fly, *Euxesta quaternaria* Loew, was found in southern Florida, closely associated with coconut palm trees. The life-cycle is completed within 37-42 days at 22°C. This species has 2N=12 chromosomes and can be reared in the laboratory. The larvae feed in the apical meristem and other soft growing parts of the palm trees, especially those damaged by lethal yellowing disease.

The life histories of most species of Otitidae are not known. According to Allen and Foote (1967) approximately 450 species have been described, but the larval feeding habits are known for only some 40 species representing 21 genera. The morphology of the immature stages has been studied even less. Thus far, the larvae and pupae have been described for about 10 species in 8 genera, and no adequate descriptions of the eggs or earlier instar larvae have been published.

The genus *Euxesta* includes more than 70 species, most of which are distributed in tropical and subtropical areas (Steyskal, 1968). The larvae of several species have been found in fruits such as oranges, pineapples, melons and apples (see Allen and Foote, 1967). They also attack rotting or damaged onion bulbs and roots of yams. Larvae have been found under the loosened bark of pecan, hickory, American elm, and in the husks of walnuts. The adults of some *Euxesta* species have been reared from larvae in sugarcane and ears of corn (see Allen and Foote, 1967). Nearly all of the reared species of this genus have saprophagous larvae, and very few of the North American species are phytophagous (Oldroyd, 1964).

Euxesta quaternaria Loew is known to be present in the West Indies (Bahamas, Cuba, Saint Thomas, Jamaica) and Panama (Steyskal, 1968). Recently the authors found large numbers of these flies on palm trees in southern Florida even though the presence of them was known earlier in this area (Steyskal, 1983, personal communication). These flies were associated mainly with palm trees affected by diseases including "lethal yellowing." In an attempt to discover any possible relationship between *E. quaternaria* and palm tree diseases, a study of the biology of this species was undertaken.

¹Received March 24, 1983. Accepted May 23, 1983.

²This work was supported by NSF Grant DEB 80-11552.

³Department of Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43403

MATERIALS AND METHODS

Studies were conducted on both field-collected and laboratory-reared specimens. Eggs and larvae were collected from the soft growing parts (cambial tissues) of the coconut palm trees (*Cocos nucifera* and Malayan dwarf) in southern Florida. These eggs along with the cambial tissue were brought to the laboratory and placed in vials. The hatched larvae were fed on modified *Drosophila* food (Yoon et al., 1972) and/or young coconut fruits. Larval vials were kept in mason jars with moistened sand in the bottom. The 3rd instar larvae pupated in the sand. The adults were studied in both natural and laboratory conditions. The laboratory rearing was done at room temperature (22°C) with a relative humidity of 70%.

The chromosomes were prepared by removing the brain ganglia of the larvae in physiological saline and allowing them to swell in a hypotonic solution of 1% sodium citrate for 10 minutes. The ganglia were then transferred to aceto-orcein stain for 10-15 minutes, mounted in 45% acetic acid solution and then squashed with thumb pressure. Slides were examined and photographed on a Zeiss phase photomicroscope. Kodak panatomic-x 35 mm film and Kodak polycontrast rapid paper F were used in photography (Yoon et al., 1972).

OBSERVATION AND DISCUSSION

The life cycle of the picture-winged fly, *E. quaternaria*, is shown in Figure 1. The eggs are deposited on the soft growing parts of the palm trees. The elongate, oval-shaped eggs (Fig. I. D), 2-3 mm long, vary in numbers from approximately 100-300 per female. The eggs are bone white in color and they hatch within 2-4 days at room temperature (22°C).

The larvae (Fig. I. E) undergo two molts and develop into 3rd instar larvae. The third instar larvae are about 8-10 mm long and 1.4-1.7 mm in width. Well-developed mouth hooks are present in the larvae (Fig. II. B2). It was observed in nature that all larval instars were very active and fed on the soft parts of the palm tree (Fig. II. B), including apical meristem, inflorescence and young fruits. Generally larvae require about 21 days to pupate at 22°C. In laboratory conditions, due to unknown reasons, some larvae took more than one month to pupate. It was found that in the laboratory they pupated in moist paper tissues and/or moistened sand. In nature the larvae pupate in sand at the base of the palm trees. They remain in the pupal stage (Fig. I. F) for about 14-16 days. The pupae are light brown in color.

The adults (Fig. I. A. & B) emerged on the 14-16th day after pupation. The adults are about 5-6 mm long. The females can be distinguished easily by their elongated pointed telescoping ovipositor (3-4 mm in length) which

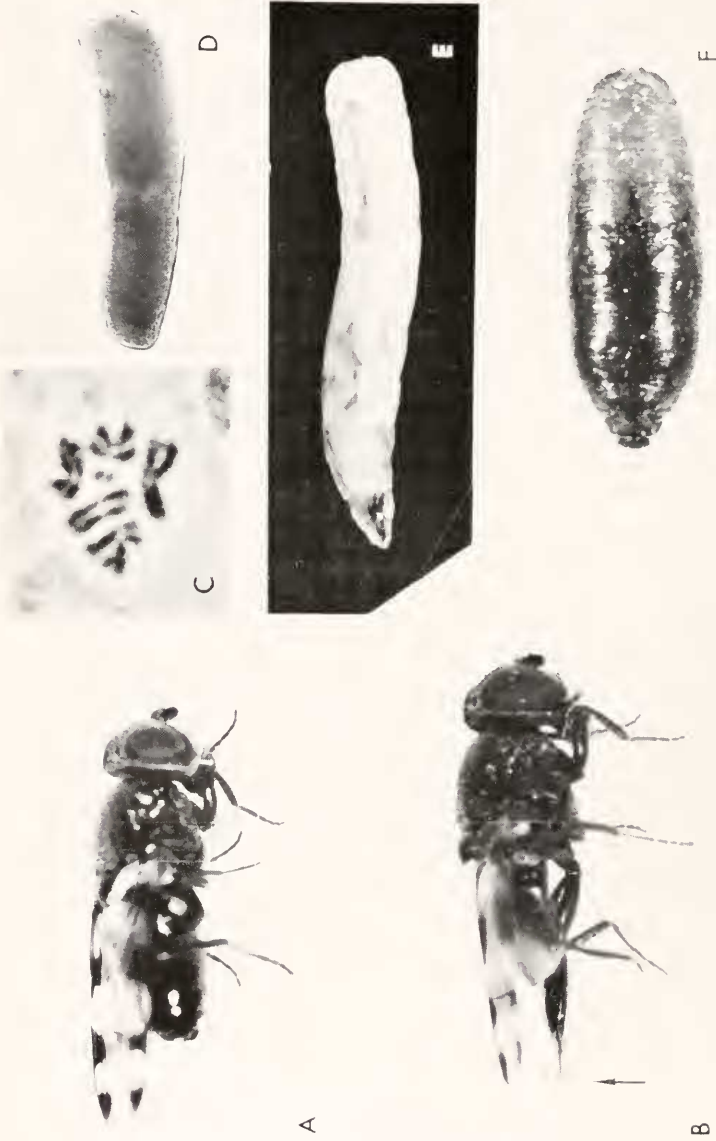


Figure 1. Life Cycle of *Euxesta quaternaria*. A. Adult male. B. Adult female, showing the ovipositor (arrow). C. Metaphase chromosomes ($2n=12$). D. Egg. 70X. E. Third instar larva. F. Pupa.



Figure 11. Damage to the Coconut Tree by *E. quaternaria*. A. Adult laying eggs on soft parts of the stem. (In the circle). A1. Female fly. (Notice the ovipositor). B. Larvae (magnified view in B1) feeding on the apical region of palm tree. Enlarged mouth hooks are shown in Fig. B2. C. A young coconut palm tree severely damaged by lethal yellowing and/or by these insects. D. Earlier stages (foreground) of infestation of lethal yellowing disease on mature trees and its final stages (dead trees).

is made up of 3 abdominal segments (Fig. I. B). Females have conspicuous yellow color on the dorsum of the abdomen. In nature, adults are found frequently on the trunks of palm trees. The adults were observed throughout the year, in the early morning or late afternoon, sitting on the sunny side of the trunks. The adults were peculiar in their wing-waving behavior. They move slowly, and constantly wave their dark-banded wings in a to-and-fro motion similar to that of many species of Tephritidae. This wing-waving is probably related to their courtship behavior. Both sexes are found to behave in this manner. This wing-waving behavior was noticed also in the laboratory (Fig. II. A₁).

It was found that *E. quaternaria* has 12 chromosomes ($2n=12$) including one pair of microchromosomes (Fig. I. C). Their polytene chromosomes are ectopically paired as predicted since the metaphase chromosomes have many heterochromatic segments in their genome.

On the basis of the present data available, it is concluded that the life cycle of *E. quaternaria* is associated with palm trees as one of the host plants. The present study indicates that *E. quaternaria* can be reared in the laboratory conditions, therefore it may be possible to establish a direct cause-relationship between the insects and such diseases as "lethal yellowing," by obtaining more data on the biology and ecology of these flies.

ACKNOWLEDGMENTS

We wish to thank Dr. B.A. Foote, Department of Biological Sciences, Kent State University, Kent, Ohio and Mr. George C. Steyskal, U.S. Department of Agriculture, Washington, D.C. for their valuable suggestions and assistance in the identification of the flies in this study. We are grateful to Dr. Robert C. Graves, Bowling Green State University, for his helpful comments on the study and for critically reading the manuscript.

LITERATURE CITED

- Allen, E.J. and B.A. Foote. 1967. Biology and immature stages of three species of Otitidae (Diptera) which have saprophagous larvae. *Ann. Ent. Soc. Amer.* 60: 828-836.
- Oldroyd, H. 1964. The natural history of flies. Weidenfeld and Nicolson, London. pp. 324.
- Steyskal, G.C. 1968. Family Otitidae. Catalogue No. 54: 1-31 (Ortalidae: including Pterocallidae, Ulidiidae). In: A catalogue of the Diptera of the Americas south of the United States. Departamento de Zoologia, Secretaria da Agricultura, Sao Paulo.
- Yoon, J.S., K. Resch and M.R. Wheeler. 1972. Cytogenetic relationships in Hawaiian species of *Drosophila*. I. The *Drosophila hystricosa* subgroup of the "Modified Mouthparts" species groups. *Studies in genetics VII*. Univ. of Texas Publ. 7213: 179-199.